DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
INFORMATION TECHNOLOGY OFFICE (ITO)
PLANNED PROCUREMENTS
September 2000

PROGRAM DESCRIPTION	FUNDING	SCHEDULE	PROGRAM MGR
Quantum Information Science and Technology (QuIST): This initiative will implement a comprehensive program of research, development, and demonstration of advances required for practical realization of potentially significant advantages of quantum mechanical effects in computing and communication. Specific areas of interest will include formulation of new algorithms and protocols for ultra-secure communications, ultra-precise metrology, information-bandwidth enhancements, exploration of the limits of quantum computation for speedups over classical computation, and computational applications for which quantum computation offers significant advantage over known classical equivalents. QuIST will concurrently develop the component technology for quantum computing and secure quantum communication including the development of robust megahertz rate single photon sources and detectors, practical implementations of single and multiple quantum bit logic gates, quantum memory, and systems level constructs such as quantum repeaters. Theoretical and hardware developments will be integrated into demonstrations that may include scalable assemblies of quantum logic and memory, quantum teleportation-based communication, ultra-precise clock synchronization and ultra-secure communication over large distances (100km).	TBD	BAA 1QFY01 Total program: 5 years	Dr. Stu Wolf Dr. Dennis Healy DSO Dr. Mike Foster ITO
Polymorphous Computing Architectures: The Polymorphous Computing Architectures (PCA) program will develop a revolutionary approach to implementing embedded computing systems to support reactive multi-mission, multi-sensor, and in-flight retargetable missions. Payload adaptation, optimization, and verification will be reduced from years to days to minutes. The PCA program will establish the ability to effectively span a broad dynamic application space by implementing a polymorphic region between an application program and PCA-developed malleable micro-architecture elements. These elements will be implemented via a family of novel malleable micro-architecture processing elements to include compute cores, caches, memory structures, data paths, network interfaces, network fabrics with incremental instructions, OS, and network protocols. These elements will have the ability to morph to changing mission and scenario demands.	TBD	BAA 4QFY00 Total program: 5 years	Dr. Robert Graybill ITO
Tolerant Networking: Develop focused technologies that support continued network operation in the presence of successful attacks, particularly addressing vulnerabilities and issues expected to arise in DoD's emerging network-centric warfare vision. These include technologies for strengthening networks by introducing fault tolerance capabilities against possible attacks at the network level, emphasizing integrity and availability; and technologies for mitigating potential vulnerabilities associated with the dynamic creation and management of mission-driven coalitions.	TBD	BAA 4QFY00 Total program: 2 years	Dr. Douglas Maughan ITO

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Networked Embedded Software Technology (NEST): The NEST program will develop coordination and synthesis services for networked embedded systems. Coordination services include fault tolerant, self-stabilizing protocols for: time; data exchange; synchronization; and replication in large, distributed, real-time systems. Synthesis services provide time-bounded solution for complex, distributed constraint satisfaction tasks required for dynamic reconfiguration of applications. The services will be designed to be optimizable for specific applications and underlying distributed computing platforms. The application and computing platform specific optimization of service packages will require automated composition. The program is to enable "fine-grain" fusion of physical and information processes. The quantitative target is to build dependable, real-time, distributed, embedded applications comprising 10^2-10^5 simple computing nodes. The nodes are networked; their operation is coordinated and dynamically reconfigured as a response to changing physical conditions and modes of operation. The nodes include physical and information system components coupled by sensors and actuators. Closed loop interaction between physical and information system components is an essential feature of relevant NEST applications and it differentiates the NEST program from general, ubiquitous computing directions. Potential examples for target applications include MEMS-based control and health management of weapon platforms, coordinated operation and control of large groups of physical objects (weapons, munitions, vehicles), and smart structures.	TBD	BAA 4QFY00 Total program: 5 years	Dr. Janos Sztipanovits ITO
Software Enabled Control (SEC): The SEC program focuses on building new control software technology, for both run-time as well as for control systems design based on sound principles of control theory and software, to provide a foundation for the next generation of software control systems. A central element of the SEC program is the exploitation of hierarchical hybrid systems concepts, which enable scalability through abstraction over large-state spaces. The goal is to use software and computation to control entirely new ranges of system types and scales, including complex, closely coordinated multi-vehicle systems that exhibit extremely large mode and state spaces. The program is sponsoring research in five areas: coordinated multi-modal control; active state models; on-line control customization; open control platform; high confidence hybrid control. Research is already ongoing in the first four areas, but additional efforts are being solicited. The fifth area is new, and highly innovative approaches are needed here.	$67M (total program)	BAA 00-51 Proposals due: 10/2/00 Total program: 5 years	Dr. Helen Gill ITO